Image

AF/2831

Docket No.: MAS-FIN-128

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MAIL STOP: APPEAL BRIEF-PATENTS

By: _____ Date: March 15, 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

Applic. No.	:	10/056,356 Confirmation No.: 8042
Inventor	:	Harry Hedler et al.
Filed	:	January 24, 2002
Title	:	Electronic Component with a Semiconductor Chip and Method of Producing the Electronic Component
TC/A.U.	:	2831
Examiner	:	Hung V. Ngo
Customer No.	:	**24131**

Hon. Commissioner for Patents
Alexandria, VA 22313-1450

BRIEF ON APPEAL

S i r :

This is an appeal from the final rejection in the Office action dated September 15, 2003, finally rejecting claims 1-12 and 28.

Appellants submit this *Brief on Appeal* in triplicate, including payment in the amount of $330.00 to cover the fee for filing the *Brief on Appeal*.

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Real Party in Interest:

This application is assigned to Infineon Technologies AG of München, Germany. The assignment will be submitted for recordation upon the termination of this appeal.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 1-12 and 28 are rejected and are under appeal. Claims 13-27 are withdrawn from further consideration.

Status of Amendments:

No claims were amended after the final Office action. *A Response under 37 CFR § 1.116* was filed on December 19, 2003. The Primary Examiner stated in an *Advisory Action* dated January 23, 2004, that the request for reconsideration had been considered but did not place the application in condition for allowance. A *Notice of Appeal* was filed on January 20, 2004.

Summary of the Invention:

As stated in the first paragraph on page 1 of the specification of the instant application, the invention relates to an electronic component with a semiconductor chip, in which the rear side and the side border regions of the semiconductor chip form outer package sides.

Appellants explained on page 15 of the specification, line 12, that, referring now to the figures of the drawing in detail and first, particularly, to Fig. 1 thereof, there is shown a perspective view a portion of a semiconductor wafer 14 to illustrate a first embodiment of the invention. In Fig. 1, reference numeral 2 identifies semiconductor chips of the semiconductor wafer 14, reference numeral 3 denotes the active upper side of the semiconductor chip 2, reference numeral 4 identifies integrated circuits that are positioned in the vicinity of the active upper side 3 of the semiconductor chip 2, reference numeral 5 identifies a passive rear side of the respective semiconductor chip 2, and reference numeral 10 identifies a plastic coating on the semiconductor wafer 14.

Appellants further explained on page 15 of the specification, line 25, that Fig. 1 shows a portion of a semiconductor wafer 14 with new semiconductor chips, the solid lines on the

surface of the plastic coating 10 are intended to show the position and situation of the separating joins 16 for the individual semiconductor chips 2. Since the separation itself takes place from the active upper side 3 of the semiconductor wafer 14, the saw blade can be guided exactly along the intended sawing routes or the separating joins 16. The closed plastic coating 10 of the semiconductor wafer is also then automatically divided up into individual regions along the separating joins 16.

It is outlined on page 16 of the specification, line 1, that the plastic coating 10 would only protect the rear side 5 of a semiconductor chip 2 from damage when the semiconductor chip 2 is cut out from a semiconductor wafer 14 in this way. Therefore, after the semiconductor wafer 14 has been divided up into individual semiconductor chips 2, the closed plastic coating 10 on the rear side of the semiconductor chip 2 is melted in a thermal treatment, and because of its properties for wetting semiconductor materials, the melted material of the plastic coating 10 also wets the edge regions, the corner regions, and the side border regions of the semiconductor chip 2. This thermal step may be combined with a thermal step that is required in the further packaging of the electronic component.

It is further outlined on page 16 of the specification, line 25, that Fig. 2 schematically shows a perspective view of a first embodiment of the invention which is an electronic component 1 that includes a transversely cut semiconductor chip 2. Components that perform the same functions as the components shown in Fig. 1 are identified by the same reference numerals. Therefore, no explanation of these components is given. The reference numeral 6 denotes side border regions of the semiconductor chip 2 and the reference numeral 7 denotes outer package sides of the electronic component 1. The reference numerals 8 denote corner regions and the reference numerals 9 denote edge regions of the electronic component 1. The reference numeral 11 identifies another plastic material, other than the plastic material of the plastic coating 10. This other plastic material 11 is used on the active surface 3 of the semiconductor chip as a wiring film 21. The wiring film 21 has, in addition to a plastic insulating film, a structured metal lamination that connects the contact areas 17 of the semiconductor chip to the external contact elements 18. The metal lamination of the wiring film 21 not occupied by external contact elements 18 is protected by a solder resist layer 20. In this embodiment of the invention, the external contact elements 18 are solder balls, which make it possible for the integrated circuits 4 of the

integrated semiconductor chip 2 to be connected directly to a printed circuit board or a ceramic module.

Appellants explained on page 17 of the specification, line 35, that, because the plastic coating has a thickness in the micrometer and submicrometer range, the size of the electronic component 1 corresponds essentially to the size of the semiconductor chip 2. The electronic component 1 is only a few micrometers or fractions of a micrometer larger than the original semiconductor chip 2. Nevertheless, the electronic component 1 is protected against damage because of the microscopically thin plastic coating, with the result that the rate of loss during testing and during further processing can be significantly reduced.

As set forth on page 18 of the specification, line 10, Fig. 3 shows a perspective view of a portion of a semiconductor wafer 14 for illustrating a second embodiment of the invention. Components shown in Fig. 3 that have the same functions as the components shown in Fig. 1 or in Fig. 2 have been identified by the same reference numerals and no additional explanation of these components has been given.

It is also stated on page 18 of the specification, line 17, that the second embodiment of the semiconductor wafer 14

differs from the first embodiment shown in Fig. 1 in that the plastic coating 10 has been applied selectively and has only been applied in the positions of the separating joins 16 on the rear side 5 of the semiconductor wafer 14. This selective application can be performed using a screen printing process or by spraying the plastic coating through a mask. After the semiconductor wafer 14 has been separated into individual semiconductor chips 2, a thermal treatment causes the plastic coating 10 to run along the corner and edge regions on the side border regions of the semiconductor chips 2 and protects them with a microscopically thin plastic coating.

Appellants stated on page 19 of the specification, line 4, that Fig. 4 shows a perspective view of a second embodiment of the invention that includes a transversely cut semiconductor chip. Components of Fig. 4 that perform the same functions as components shown in Figs. 1 to 3 have been identified by the same reference numerals and have not been explained in any more detail.

Appellants further stated on page 19 of the specification, line 11, that, in the embodiment of the invention shown in Fig. 4, the rear side 5 of the semiconductor chip 2 is for the most part left free and has no plastic coating. The surface of the rear side 5 of the semiconductor chip 2 directly forms

the side of an outer package. It is possible for the unprotected rear side 5 of a semiconductor wafer 2 to be used directly as the outer package side for semiconductor materials that are resistant to oxidation and corrosion. These semiconductor materials include silicon, which in a damp and oxidizing atmosphere, forms an impenetrable protective silicon dioxide layer with good adhesion.

It is described in the last paragraph on page 19 of the specification, line 12, that, in the embodiment shown in Fig. 4, just the corner regions 8, the edge regions 9, and the side border regions 6 of the semiconductor chip 2 are provided with a plastic coating 10. For this purpose, the plastic webs 19 (shown in Fig. 3) of the plastic coating 10 melt by a thermal treatment. The corner regions 8, the edge regions 9 and the side border regions 6 of the semiconductor chip 2 are wetted and are consequently protected after the plastic layer has set. By suitably selecting the material of the plastic coating 10, only semiconductor surfaces of the semiconductor chip 2 are wetted by the melted plastic material, while the solid plastic material 11, which covers the active upper side 3 of the semiconductor chip 2, is wetted less or not at all by the plastic material of the plastic coating. Consequently, the plastic material for example of a wiring film 21 on the active upper side 3 of the semiconductor chip 2 remains free of any

additional plastic coating. Consequently, the function of the external contact elements 18 is also not impaired during the operation of wetting and protecting the side border regions 6 of the semiconductor chip 2.

References Cited:

U.S. Patent No. 5,879,964 (Paik et al.), dated March 9, 1999.

Issues

1. Whether or not claims 1-5 and 28 are anticipated by Paik et al. under 35 U.S.C. §102(b).

2. Whether or not claims 6-12 are obvious over Paik et al. under 35 U.S.C. §103(a).

Grouping of Claims:

Claim 1 is independent. Claims 2-12 and 28 depend on claim 1. The patentability of claims 2-12 and 28 is not separately argued. Therefore, claims 2-12 and 28 stand or fall with claim 1.

Arguments:

In item 2 on page 2 of the final Office action, claims 1-5 and 28 have been rejected as being anticipated by Paik et al. under 35 U.S.C. § 102(b).

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 calls for, inter alia:

> at least said corner regions of said rear side, said edge regions of said rear side, and said side border regions of said semiconductor chip having a plastic coating with a thickness between 0.5 µm and 50 µm. (Emphasis added.)

Paik et al. do not disclose a semiconductor chip with "said side border regions of said semiconductor chip having a plastic coating with a thickness between 0.5 µm and 50 µm" as recited in claim 1 of the instant application. In fact, it is quite clear that the process of Paik et al. cannot result in a chip where all four sides of the chip are coated with plastic.

Paik et al. state in column 3, lines 44-46, that each wafer strip 2 contains a plurality of dies 1, for example, 4 to 6 dies. Those wafer strips 2 undergo the coating process as is also clearly shown in the figures, particularly Figs. 4 and 5. In the final step, the wafers are "cut into separate packages" (see column 5, line 13, and Fig 6 of Paik et al.). It is, therefore, clear that the packages at each end of the wafer strip are covered by plastic only on three sides and the packages in the center of the wafer strip are covered only on

two sides because the remaining sides of the packages have been formed after the end of the coating process.

Fig. 6 is a top view of a package coated on three sides by plastic. Fig. 6 clearly shows that the side of the chip represented by the single upper horizontal line is not covered by the plastic coating 4, whereas the sides of the chip represented by the vertical lines and the lower horizontal line are covered by the plastic coating 4 as shown by the second outer vertical and lower horizontal lines.

Fig. 6a represents a cross-section taken horizontally across Fig. 6. A vertical cross-section would show that the side of the chip represented by the upper horizontal line in Fig. 6 has no plastic covering.

Although Paik et al. mention, in column 5, lines 31-38, reinforcing the backsides of each chip, they do not mention coating the sides.

In contrast, in the invention of the instant application, all four sides of the chip are covered by a plastic coating in the micrometer range. It is clearly described on page 16, lines 11-23, of the specification of the instant application that the heat treatment which causes the plastic coating to soften

and melt, covering the corner regions, edge regions and side regions, is performed after the chips have been cut from the wafer. This enables all four sides of the chip to be coated by the plastic.

The invention of the instant application also represents a clear improvement over Paik et al. because all four sides are covered by a thin plastic coating. This provides improved resistance to breakage and spalling of the crystalline material of the chips. This is particularly advantageous during testing of the chip as stated on page 1, line 16 to page 2, line 2 of the specification of the instant application.

Clearly, Paik et al. do not show "at least said corner regions of said rear side, said edge regions of said rear side, and said side border regions of said semiconductor chip having a plastic coating with a thickness between 0.5 µm and 50 µm," as recited in claim 1 of the instant application.

Claim 1 is, therefore, believed to be patentable over Paik et al. and since claims 2-5 and 28 are dependent on claim 1, they are believed to be patentable as well.

In item 3 on pages 2-3 of the final Office action, claims 6-12 have been rejected as being unpatentable over Paik et al. under 35 U.S.C. § 103(a).

As discussed above, claim 1 is believed to be patentable over the art. Since claims 6-12 are dependent on claim 1, they are believed to be patentable as well.

In view of the forgoing, the honorable Board is therefore respectfully urged to reverse the final rejection of the Primary Examiner.

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Respectfully submitted,

For Appellants

YC/bb

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Appendix - Appealed Claims:

1. An electronic component, comprising:

a semiconductor chip having an active upper side with integrated circuits, a passive rear side, and side border regions;

said rear side and said side border regions of said semiconductor chip being outer package sides;

said rear side having corner regions and edge regions; and

at least said corner regions of said rear side, said edge regions of said rear side, and said side border regions of said semiconductor chip having a plastic coating with a thickness between 0.5 µm and 50 µm.

2. The electronic component according to claim 1, wherein said rear side of said semiconductor chip is completely covered by said plastic coating.

3. The electronic component according to claim 1 wherein said plastic coating has a state, selected from the group consisting of a softened state and a melted state, said

plastic coating does not wet surfaces of other solid plastic materials but wets surfaces of semiconductor materials.

4. The electronic component according to claim 1, wherein said plastic coating in the state selected from the group consisting of the softened state and the melted state is adhesive with respect to semiconductor surfaces.

5. The electronic component according to claim 1, wherein said plastic coating includes a material selected from the group consisting of a polymer and a copolymer.

6. The electronic component according to claim 1, wherein said plastic coating includes a thermoplastic.

7. The electronic component according to claim 1, wherein said plastic coating includes a material selected from the group consisting of a colophony, a disproportionated colophony and a esterified colophony.

8. The electronic component according to claim 1, wherein said plastic coating includes a phthalate resin.

9. The electronic component according to claim 1, wherein said plastic coating includes a dimethyl glycol phthalate.

10. The electronic component according to claim 1, wherein said plastic coating includes color pigments.

11. The electronic component according to claim 1, wherein said semiconductor chip includes silicon.

12. The electronic component according to claim 1, wherein said semiconductor chip has a crystal orientation of <100>.

28. The electronic component according to claim 1, wherein said plastic coating has a thickness below 15 μm.